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Counties Manukau Health
Private Bag 93 3311
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05 July 2019

Attention: Chester Buller (Manager Capital Works)

Dear Chester,

Strengthening Summary - Middlemore Building 30 - Esme Green

We have now completed our Detailed Seismic Assessment (DSA) of the Esme Green Building (Middlemore Building 30) at Middlemore Hospital, Auckland. The score of the building is 25*%NBS* (IL3) governed by the performance of several isolated shear wall elements. These shear wall elements have a disproportionate impact on the seismic rating to the building due to their importance to maintaining support to the floors and lateral stability of the building.

The purpose of this correspondence is to provide additional detail around strengthening options, including the implications of increasing the target strengthening level to sit above the potentially Earthquake Risk threshold of 67*%NBS*.

The graph below shows the relationship between the effort to strengthen (cost and intrusiveness on occupants) and the earthquake risk for the Esme Green building. It can be seen that the largest improvement in the earthquake risk is achieved by pushing the building from where it currently sits, to >34*%NBS*.

As the target level is increased, the strengthening costs and intrusiveness increase disproportionately for the Esme Green Building. This is due to the age and construction of the building. While there are few elements that are < 34*%NBS* , there are numerous members that sit in the Earthquake Risk range of 34 – 67*%NBS* and strengthening schemes would need to fundamentally change the structural system of the building.

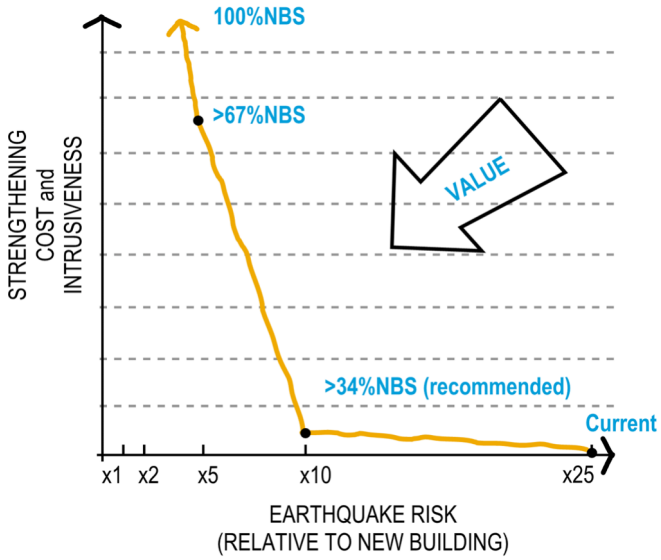

Figure 1: Graph of the relative earthquake risk and strengthening costs to improve

Strengthening to 35*%NBS* (Recommended)

The DSA report has provided high level concept strengthening schemes to bring the building's seismic rating to above 34*%NBS* (IL3). This strengthening targets the critical structural elements and features of the building that are currently less than 34*%NBS* (IL3). These elements are discrete and located in the South and East Wing buildings:

- South Wing
  - Strengthen existing wall - Wall at ground floor level on Gridline 9 (in main lobby of building near the lifts) – retrofit with thickening to the wall
- East Wing
  - Removal or fixing back of unreinforced masonry veneer above the egress paths to the building
  - New wall - Additional wall at eastern elevation of the building

The figure below highlights the extent of strengthening required to achieve 35*%NBS*. The North Wing and Linen Store building do not require any strengthening to meeting this strengthening target.

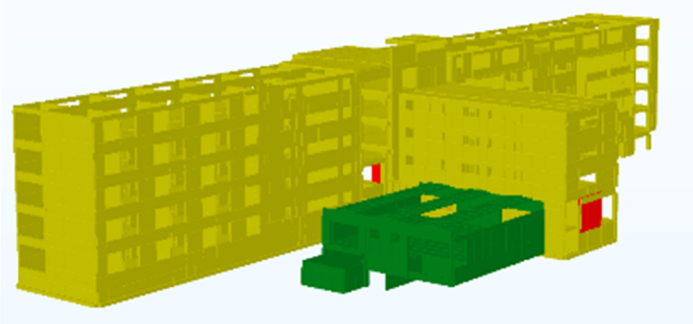

Figure 2: 3D view of the Esme Green structural model with the elements < 34%NBS shown in red

Strengthening to >67*%NBS*

The strengthening to achieve >67*%NBS* is much more extensive. Only the most critical walls, floor slabs and gravity frame elements (beams and columns) are reported in the DSA. Our analysis shows that there are numerous elements that would require strengthening. Localised strengthening to these elements would unlikely to be practical and more extensive fundamental revisions of the lateral load resisting systems would be required. This may include some or all of the following:

- New lateral load resisting system – the existing wall system makes the installation of retrofitted lateral load systems difficult. Steel bracing would unlikely be able to significantly improve the performance of the shear walls. New load paths would also need to be considered such as drag beams and concrete floor diaphragm strengthening. New multi-storey shear walls would likely be stiff enough, however would be difficult to construct.
- New energy dissipating devices – there are various mechanical devices designed to reduce the seismic demand on buildings by dissipating the energy imparted on the structure. Examples of these include friction sliders and viscous dampers.
- Seismic isolation – this would utilise the existing basement to provide an isolation plane. The seismic isolation would significantly reduce the seismic demands on the building, requiring limited work to the superstructure, however would involve extensive costs to implement.

While we do not have detailed costing for this scheme, we expect it to be orders of magnitude more than strengthening to 35*%NBS*.

Recommendations

We recommend that Option 1 (strengthening to 35*%NBS*) is pursued by Counties Manukau Health on the basis that it provides the best value and a 'sweet spot' between investment in strengthening and reduction in the seismic risk It is our understanding that the Esme Green building is not part of CMH's long-term plan for the site and hence any major investment in the building is non-preferred.

Please do not hesitate to contact us if you have any questions regarding the content of this letter.

Jared Keen

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on behalf of

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Copy to: Angelo Garcia (CMH)